On The Use Of Dual Polarized Interferometry To Measure Scattering From Vegetated Areas

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Several polarimetric scattering models for vegetated surfaces have been developed over the past fcw years. Most of these models predict scattering from cross-polarized returns to come mostly from the randomly oriented branches, twigs and leaves, while the co-polarized return comes mainly from lower down in the canopy. Few experiments have actually measured the position in the canopy from which the scattering originates.

During the 1993 flight campaign, the AIRSAR instrument was reconfigured to measure interferograms at both VV and HV polarizations at C-band. This was achieved by transmitting out of the AIRSAR C-band polarimetric antenna, and transmitting alternately horizontal and vertical polarizations. The scattered signals were than measured simultaneously using two vertically polarized antennas, separated by about 2.4 meters on the fuselage of the DC-8 aircraft.

Since the phase in the interferograms is related to the elevation of each pixel, one can measure the difference in penetration into the vegetation by comparing the difference in elevation derived from the c.o-polarized and cross-polarized interferograms. This is a simple and effective way to actually measure the relative positions of the scattering centers for the co- and cross-polarized returns.

Data were acquired over a uniform tropical rain forest in French Guyana. The scene anal yzed contains mostly rain forest, but a large river also runs through the image, allowing one to calibrate the relative elevations in the VV and HV elevation maps. The results show the r.m.s height variation on the surface of the river to be about 1 m in the VV elevation map, and slightly larger in the HV map. The forest is measured as about 20 m above the level of the river in the VV map, (note that this is not necessarily the true height of the trees) and only about 16 m above the level of the river in the HV map. Thus, the VV returns come form 4 m higher in the trees than the HV signals.

Wc plan to repeat this experiment over different types of vegetation during the 1995. flight season. This year the AIRSAR system was upgraded to allow simultaneous L- and C-band interferometric data acquisition. Wc plan to repeat this experiment using both frequencies.